Potential Cooperative Measures for Civilian Nuclear Facilities
An Example Analysis Linking Policy or Agreement Goals with Specific Information to Share

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Introduction

Cooperative measures involve cooperatively sharing information with a goal of building confidence and trust between the information sharing partners. Cooperative measures can be characterized by what information is shared, how the information is shared and what groups share the information. The sharing of information could be between different groups within one facility, different groups within one country, or between multiple countries. The formality of the arrangements leading to the information sharing could range from very informal person-to-person or group-to-group arrangements to formal bilateral or multilateral agreements between countries. The ways that information could be shared vary from informal discussions, visits and transfers of electronic information to formal exchanges of documents, inspections and electronic information. In many cases the same cooperative measures that are designed to build

confidence and trust between organizations or facilities can also help to improve the performance of the organizations or facilities.

Document Objectives and Organization

The first objective of this paper is to identify a broad spectrum of potential cooperative measures that could lead to building confidence that civilian nuclear facility operations are safe and environmentally sound and that the nuclear materials associated with these facilities are appropriately protected from theft or sabotage. This spectrum of potential cooperative measures would involve sharing various types and levels of information about various civilian nuclear facility operations.

The second objective of this paper is to document and demonstrate a process for identifying information that could be shared to support policy or agreement goals. Given a goal, the process involves 1) identifying what information is relevant to the goal, 2) identifying what methods could be used to share the relevant information, and 3) identifying the benefits and costs of sharing the relevant information. The benefits and costs of various options can be used to make decisions about implementing informal information sharing options or making formal agreements with potential information sharing partners. Six example applications of this process, involving three goals for each of two 'facilities', will be summarized in this report. The three example goals are:

1. to increase regional confidence that a given facility is being operated in a safe manner
2. to increase regional confidence that a given facility is being operated in an environmentally sound manner
3. to increase regional confidence that nuclear materials associated with a given facility are being appropriately protected from theft or sabotage

The two example facilities are a Light Water Reactor (LWR) used for nuclear power generation and a nuclear waste geologic disposal facility used for civilian nuclear waste. The same process could be applied to other policy goals such as to reduce regional tensions associated with the deployment of conventional arms or to increase domestic public confidence in the operation of nuclear power facilities, for example.

Figure 1 illustrates the organization of the discussion of applying the process to the three example goals.

	RELEVANT INFORMATION TO SHARE	**METHODS** TO SHARE INFORMATION	**COST/BENEFIT** OF SHARING INFORMATION
ENVIRONMENTAL PROTECTION COOPERATON			
OPRATIONAL SAFETY COOPERATION			
MATERIAL PROTECTION COOPERATION			

Figure 1 - Organization of the Following Discussion

After some general comments on relevance, methods and costs/benefits, the discussion will focus on the goal of environmental protection cooperation, and within that goal will proceed from what information is

relevant through what methods can be used to share the information to the costs and benefits of sharing the information. The discussion of information relevance will be independent of a specific facility. The discussions of information sharing methods, with specific examples of information that could be shared and the associated benefits and costs, is more dependent on the specific facilities under consideration. The discussion will then apply the process to the goals of operational safety cooperation and material protection cooperation.

General Comments On Information Relevance

This analysis will require that shared information be logically related to a 'potential for regional impact' before including it within the information that is judged to be relevant and could be shared. This requirement has been selected to assure that benefits of sharing the information are available to offset potential costs of sharing the information. In some cases information that meets the 'potential for regional impact' relevancy test, but involves loss of control issues, could be shared subject to limits designed to minimize the 'loss of control' indirect costs. This 'potential for regional impact' criterion will be applied for all of the goals.

General Comments On Information Sharing Methods

Information can be shared many ways. Private discussions between individuals, papers given at topical meetings, and a formal exchange of specially prepared documents are all examples of information sharing. The value of the information may depend on the level of the individuals involved in the discussion or the preparation of the documents. Informal visits or formal inspections of facilities are also ways to share information. The exchange of electronic information from measurement sensors is a way of rapidly exchanging large amounts of information. The electronic transfer of information from real time location sensors for nuclear waste transportation operations is one example of remote monitoring.

Different ways of sharing information have different characteristics. For example sharing airborne radionuclide concentration sensor information by mailing monthly documents between two or more organizations or facilities introduces a time delay of weeks to more than a month between the measurement time and the information availability time. Sharing this same information by remote monitoring introduces a time delay of seconds to minutes to hours, depending on measurement and communication techniques. If one of the motivations for sharing the information was to provide early warning of a developing radiological emergency, the more timely remote monitored information would be higher value information. If the motivation for sharing the information was to evaluate predictive models, then the document exchange data would have essentially the same value as the more timely remote monitored data.

General Comments On Benefits and Costs of Sharing Information

Benefits and costs of sharing information include both 'general' and specific benefits or costs associated with specific items of shared information. Potential general benefits include increasing confidence, trust or stability between the information sharing partners, improved economic performance by participating organizations or facilities, and reduced public health, environmental and loss of control of nuclear material risks within a region. Potential general costs include the direct economic costs of sharing the information and indirect 'costs' of losing some level of control over the shared information. Examples of potential indirect 'costs' include the potential for loss of control of propriety, private, or embarrassing information.

Environmental Protection Cooperation

Environmental cooperation involves sharing information that could either build confidence that civilian nuclear facility operations are environmentally sound or that could reduce the probability or consequences of environmental releases of radionuclides.

What Information Is Relevant To Environmental Protection Cooperation?

The primary regional environmental issue associated with civilian nuclear facilities is the release of radionuclides, not hazardous chemicals or thermal effluents. Regional scale radionuclide transport can occur with airborne or waterborne pathways.

Given these observations, *information about radioactive effluents or accidental releases from civilian nuclear facilities or transportation operations* is relevant to regional environmental protection cooperation since these effluents or accidental releases are the source terms for potential regional transport. *Information about water pathways with the potential to reach another country or the ocean and airborne pathways* is relevant to regional environmental protection cooperation since these pathways have a potential for regional transport. *Information about and from airborne and waterborne radionuclide sensors* is relevant to regional environmental protection cooperation since these sensors can measure radionuclide concentrations within potential transport pathways.

What Methods Could Be Used To Share Environmental Protection Information?

Figure 2 includes three general techniques of sharing information; discussions and the exchange of documents, visits and observations of facilities, and remote monitoring. Within the context of these three general methods of sharing information, Figure 2 also includes specific 'environmental protection related information that could be shared' examples for a light water reactor and for a nuclear waste geologic disposal facility.

	LIGHT WATER REACTOR	WASTE DISPOSAL FACILITY
DISCUSS, DOCUMENT EXCHANGE	LWR Effluent Release History; Nuclear Waste Generation and Treatment Records; Radionuclide Concentration Sensor Design; Historic Meteorological Data	Disposal Facility Effluent Release History; Facility Waste Acceptance Criteria; Historic Waste Characterization Data
VISIT AND OBSERVE	LWR Effluent Release Points; Location and Condition of Airborne and Waterborne Radionuclide Concentration Sensors	Waste Disposal Facility Design and Site; Waste Characterization Activities; Waste Package External Radiation Levels; Waste Disposal Facility Regulator
REMOTE MONITOR	LWR Effluent Radiation Monitors; Airborne and Waterborne Radionuclide Concentrations; Meteorological Data; Water Transport Data	Facility Effluent Radiation Monitors; Real Time Airborne and Waterborne Radionuclide Concentrations Prior To, During, and After Waste Acceptance

Figure 2 - Methods for Sharing Example Environmental Protection Information

What Are Potential Benefits and Costs of Sharing Environmental Protection Information?

Shared information about radioactive effluents from and transport around civilian nuclear facilities could be used to model regional transport of effluents and evaluate if these effluents could have a regional radiological impact. Specific benefits exist for both the case where appropriate modeling indicate regional impacts (now we understand that this level of effluents from this facility can impact the region) and the case with no regional impact (now we understand that this level of effluent from this facility does not impact the region). In addition this information about effluents and transport parameters could be used to

test model predictions by comparing them with observed airborne and waterborne concentrations at various locations. In this case the specific benefit could be regional trust in a model.

Appendix A focuses on example benefits and costs of sharing Light Water Reactor environmental protection information. The example information elements of Appendix A duplicate the information elements listed in the Light Water Reactor column of Figure 2. The example benefits described in Appendix A primarily support radionuclide transport modeling as described above. The example costs described in Appendix A include staff time to gather and send records and host visits, the potential for loss of proprietary information, the potential for embarrassment or liability, the potential need for regulators approval, and design, procurement, installation and maintenance costs associated with remote monitoring equipment. See Appendix A for a more detailed discussion of both benefits and costs.

Appendix B focuses on example benefits and costs of sharing waste disposal facility environmental protection information. The example benefits described in Appendix B primarily support radionuclide transport modeling and building confidence that the design and operation of the waste disposal facility is consistent with protecting the environment. In general the example costs described in Appendix B for sharing information from a waste disposal facility are similar to the example costs described in Appendix A for sharing information from a Light Water Reactor described above. See Appendix B for a more detailed discussion of both benefits and costs.

Operational Safety Cooperation

Operational safety cooperative measures involve sharing information that could build confidence that civilian nuclear facility operations are safe or that could identify specific operational safety areas that could be improved and decrease the risk to the surrounding population.

What Information Is Relevant to Operational Safety Cooperation?

Civilian nuclear facility accidents are judged to have a potential for regional impact since they could release radionuclides to regional scale transport pathways. Overall poor operational safety can manifest itself in a variety of ways, e.g. poor equipment test performance, poor record keeping, general plant housekeeping, and (for reactors) numerous reactor or turbine trips and extended outages.

Given these observations, *information about regulatory oversight, self assessments, test and maintenance activities, safety functions and equipment and the availability of back-up safety equipment* is relevant to regional operational safety cooperation since this information could contribute to regional confidence that civilian nuclear facilities are being operated safely and could reduce the probability or consequences of accidental releases of radionuclides from civilian nuclear facilities.

What Methods Could Be Used To Share This Operational Safety Information?

Figure 3 includes three general techniques of sharing information; discussions and the exchange of documents, visits and observations of facilities, and remote monitoring. Within the context of these three general methods of sharing information, Figure 3 also includes specific 'operational safety related information that could be shared' examples for a light water reactor and for a nuclear waste geologic disposal facility.

	LIGHT WATER REACTOR	WASTE DISPOSAL FACILITY
DISCUSS, DOCUMENT EXCHANGE	Operator Recertification Records; Unusual Occurrence Reports; Review of Probabilistic Risk Assessments (PRAs); Test and Maintenance Records	Safety Analysis Documentation; Waste Disposal Facility As-Built Drawings; Unusual Occurrence Reports; Test and Maintenance Records; Site Characterization Data
VISIT AND OBSERVE	Sample of Test and Maintenance Activities; Annual Visits; Unannounced Focused Observations of Topics Identified By Review of Documents	Compare Actual Safety Systems With As-Built Drawings; Maintenance of Safety Systems; Compare On-Site Waste With Waste Acceptance Criteria
REMOTE MONITOR	LWR Effluent Radiation Monitors; Reactor Thermal and Plant Electrical Output Power; Meteorological Data; Availability of Back-Up Safety Equipment; Key Safety Functions	Real Time Airborne and Waterborne Radionuclide Concentrations; Individual Waste Package Radionuclide Inventory

Figure 3 - Methods For Sharing Example Operational Safety Information

What Are Potential Benefits And Costs Of Sharing Operational Safety Information?

Information from regulatory or oversight records could be reviewed to develop confidence that safety related regulations are being followed and that the regulatory body is being watchful. Information from operational records could be used to evaluate unusual occurrence trends and follow-up and to evaluate equipment performance problems. Information from on-site visits could include observing if test and maintenance activities are implemented properly and observations regarding general plant conditions and operator performance. Information about key safety functions and equipment could include observations about the scheduling of maintenance for back-up safety equipment and how that impacts operational safety of the facility. The benefit of these activities is either to develop confidence that appropriate regulatory and operational safety processes are being implemented or to identify regulatory or operational processes that need to be improved and, when improved, will lead to improved operational safety with less risk of accidents that could have regional impacts. Shared information about and from airborne and waterborne radionuclide sensors could be used to provide early warning of a developing radiological emergency. This same information could also be used to compare and test predictive models developed for emergency response management. The specific benefit of earlier warning of a developing radiological emergency would be an earlier opportunity to apply public health procedures and reduce both public health and economic consequences of a radiological emergency.

Appendix C focuses on example benefits and costs of sharing Light Water Reactor operational safety information. The example information elements of Appendix C duplicate the information elements listed in the Light Water Reactor column of Figure 3. The example benefits described in Appendix C primarily support confidence building in the execution of operational safety programs and early warning of accidental radionuclide releases as described above. The example costs described in Appendix C include staff time to gather and send records and host visits, the potential for loss of proprietary information, the potential for embarrassment or liability, the potential need for regulators approval, and design, procurement, installation and maintenance costs associated with remote monitoring equipment. See Appendix C for a more detailed discussion of both benefits and costs.

Appendix D focuses on example benefits and costs of sharing waste disposal facility operational safety information. The example benefits described in Appendix D primarily support building confidence that the design and operation of the waste disposal facility is consistent with protecting the environment. In general the example costs described in Appendix D for sharing information from a waste disposal facility are similar to the example costs described in Appendix C for sharing information from a Light Water Reactor described above. See Appendix D for a more detailed discussion of both benefits and costs.

Material Protection Cooperation

Material protection cooperation involves sharing information that could either build confidence that nuclear materials associated with a civilian nuclear facility are appropriately protected with minimal risk of theft or sabotage, or could identify areas where the protection of these materials could be improved.

What Information Is Relevant To Material Protection Cooperation?

Highly radioactive materials could be used to create 'radiological dispersal' incidents; fresh uranium fuel for a typical LWR could be further enriched to produce highly enriched uranium (HEU); spent fuel could be reprocessed to separate plutonium. All of these materials could be used for destructive purposes. The destructive use of these materials has a potential for regional impact. Normal operation of a civilian nuclear facility involves limited access by individuals to these nuclear materials, a limited number of storage locations for these materials and a limited number of movements of these materials.

Given these observations, *information about the facility design, the facility operations, and the movement of nuclear materials within and out of the facility site* would contribute to regional confidence that nuclear materials associated with the facility are adequately protected from theft or sabotage and is relevant to regional material protection cooperation. Sharing this type of information involves a tradeoff between building confidence with information sharing partners and providing detailed material protection information that could aid potential thieves or saboteurs. Information considered for sharing should be reviewed considering both perspectives.

What Methods Could Be Used to Share This Material Protection Information?

Figure 4 includes three general techniques of sharing information; discussions and the exchange of documents, visits and observations of facilities, and remote monitoring. Within the context of these three general methods of sharing information, Figure 4 also includes specific 'material protection related information that could be shared' examples for a light water reactor and for a nuclear waste geologic disposal facility.

What Are Potential Benefits and Costs of Sharing Material Protection Information?

Information about facility design and operational procedures could be reviewed to develop confidence that nuclear materials are being protected in an appropriate manner. Event triggered video coverage of nuclear material storage locations could provide very specific and convincing evidence that access to nuclear materials is controlled and that these materials are not being stolen or diverted for inappropriate application.

Appendix E focuses on example benefits and costs of sharing Light Water Reactor material protection information. The example information elements of Appendix E duplicate the information elements listed in the Light Water Reactor column of Figure 4. The example benefits described in Appendix E primarily support building confidence that nuclear materials associated with the Light Water Reactor are being protected in an appropriate manner. The example costs described in Appendix E include staff time to gather and send records and host visits, the potential need for regulators approval, the design, procurement, installation and maintenance costs associated with remote monitoring equipment and the potential costs of limiting access to information to avoid helping potential thieves or saboteurs. See Appendix E for a more detailed discussion of both benefits and costs.

	LIGHT WATER REACTOR	WASTE DISPOSAL FACILITY
DISCUSS, DOCUMENT EXCHANGE	Discuss Facility Design and Operational Aspects of: Fresh Fuel Protection Program; Spent Fuel Protection Program; Waste Storage and Treatment Protection Program	Disposal Facility Design Records; Waste Acceptance Criteria; Waste Characterization Data; Waste Package Radionuclide Inventories
VISIT AND OBSERVE	Observe Facility Design and Operational Aspects of: Fresh Fuel Protection Program; Spent Fuel Protection Program; Waste Storage and Treatment Protection Program	As Built Disposal Facility; Waste Characterization Equipment; Waste Disposal Facility Regulator; Review Site and Repository Facility Closure Plan
REMOTE MONITOR	Event Triggered Video Monitoring of On-Site Nuclear Material Storage and Movements; Location and Condition Monitoring of Off-Site Nuclear Material Movements	Event Triggered Video Coverage of Nuclear Material Movements During Repository Operations; Event Triggered Seismic Coverage After Repository Closure

Figure 4 - Methods for Sharing Example Material Protection Information

Appendix F focuses on example benefits and costs of sharing waste disposal facility material protection information. The example benefits described in Appendix F primarily support building confidence that the design and operation of the waste disposal facility is consistent with the protection of nuclear materials. The example costs described in Appendix F for sharing information from a waste disposal facility are similar to the example costs described in Appendix E for sharing information from a Light Water Reactor described above. See Appendix F for a more detailed discussion of both benefits and costs.

How Do These Material Protection Cooperative Measures Compare With IAEA Safeguards?

The following *italicized text* is taken from portions of an IAEA "Safeguards Factsheet" (available at www.iaea.or.at/worldatom/inforesource/factsheets/safeguards.html).

In operation since the 1960s, the safeguards system of the International Atomic Energy Agency (IAEA) is a central component of the world's commitment to control the spread of nuclear weapons. Under agreements that States conclude with the IAEA, Agency inspectors regularly visit nuclear facilities to verify records that State authorities keep on the whereabouts of nuclear materials under their control, check IAEA-installed instruments and surveillance equipment, and confirm physical inventories of nuclear materials. They then prepare detailed reports to the States concerned and to the IAEA. Taken together, these and other safeguard measures provide independent, international verification that governments are living up to their commitments to peaceful uses of nuclear technology.

The (IAEA safeguards) *system consists of three major components:*

- ***Accountancy**, i.e. reporting by States on the whereabouts of the fissionable material under their control, on stocks of fuel and of spent fuel, on the processing and reprocessing of nuclear materials, etc.;*

- ***Containment and surveillance*** *techniques, such as seals which allow conclusions that no material has disappeared, film and TV-cameras which record any action occurring in a particular area of a nuclear installation; and*

- ***Inspection*** *by Agency inspectors, checking instruments and seals installed, verifying books, confirming physical inventories of fuel or spent fuel.*

The example material protection cooperative measures described in this document are fundamentally different then the IAEA Safeguards program in that:

- The material protection cooperative measures described in this document have an objective of building confidence between the various information sharing groups that nuclear materials are appropriately protected from theft or sabotage while the IAEA Safeguards program measures "… provide independent, international verification that governments are living up to their commitment to peaceful uses of nuclear technology …" and only involve the one State, or one group of States, sharing information with the IAEA. The IAEA Safeguards program does not address protection from theft or sabotage.

- The cooperative measures described in this document could involve information sharing by various groups (different groups within one facility, different groups within one State, different groups within multiple States, multiple States themselves, etc.) while the IAEA Safeguards program involves information sharing between the one State, or one group of States, and the IAEA.

- The cooperative measures described in this document could involve many different levels of formality of the information sharing arrangements (very informal person-to-person or group-to-group arrangements to formal bilateral or multilateral agreements between States) while the IAEA Safeguards program requires a formal agreement between the one State, or one group of States, and the IAEA.

The material protection cooperative measures described within this document involve flexible arrangements between flexible groups sharing information related to the protection of nuclear materials from theft or sabotage. The IAEA Safeguards program involves formal arrangements between one State, or one group of States, and the IAEA sharing information related to the States commitment to peaceful uses of nuclear technology.

It would be possible to have a formal agreement between two or more States to cooperatively exchange information similar to the information involved in IAEA Safeguard activities. The result of such an agreement could be confidence building between the States implementing such an agreement. But such an agreement could not replace the international character of the IAEA Safeguards program.

Summary

This document has described a process that can be used to link policy or agreement goals to specific information to share. The process involves:

1. identifying what information is relevant to the goal
2. identifying what methods could be used to share relevant information
3. identifying the benefits and costs of sharing elements of relevant information

Within this document the process has been illustrated with six example applications involving three goals for each of two civilian nuclear facilities.

Who Could Use This Process and Why Would They Use It?

This process could be used by individuals or groups interested in learning about cooperative measures and how these measures could contribute to confidence building. An individual or group could use this process to identify technology understanding, technology development, or technology testing needed to support a proposed confidence building goal. This process could be used to identify knowledge or experience backgrounds needed on a negotiation team preparing to negotiate an agreement in support of a confidence building goal. This process could be used to define experiments in information sharing where the experiments could build informal current time trust with limited formal long term information sharing commitments. This process could be used by one group, or by multiple groups, prior to or during a negotiation, to informally look for win/win negotiation options. If each party to a negotiation can understand what information is important to the other party as well as what information is important to themselves, the creation of potential win/win negotiation options has a higher probability.

Appendix A - Example Benefits and Costs of Sharing

Light Water Reactor Environmental Protection Information

	Example Information	Benefits of Sharing Information	Costs of Sharing Information
DISCUSS	LWR Effluent Release History	Provides effluent source term for historic modeling of regional transport; Supports historic transport modeling to evaluate if normal operations of the facility are a risk to the region	Staff time to gather and send records; Some potential for embarrassment or liability
	Nuclear Waste Generation and Treatment Records	Builds confidence that appropriate treatment is implemented	Staff time to gather and send records; Some potential for embarrassment or liability
	Radionuclide Concentration Sensor Design	Supports evaluation of reliability of data from the concentration sensor	Staff time to gather and send records; Potential for loss of proprietary radionuclide concentration sensor design information;
	Historic Meteorological Data	Portion of transport parameters for modeling airborne regional transport	Staff time to gather and send data
VISIT	LWR Effluent Release Points	Supports development of regional transport model	Staff time to host visit and, if requested, send maps/surveys
	Location and Condition of Airborne and Waterborne Radionuclide Concentration Sensors	Supports evaluation of reliability of data from the sensor; Supports evaluation of regional transport model	Staff time to host visit and, if requested, send associated documents or reports
	LWR Effluent Radiation Monitors	Provides early indication that a regional release does not come from the facility; Provides early warning of accidental releases; Real time concentration source term for regional transport model	Design, procure, install, and maintain data transmission equipment; May need regulators approval to use present sensors; Some potential for embarrassment or liability
MONITOR	Airborne and Waterborne Radionuclide Concentrations	Provides early indication that a regional release does not come from a nearby facility; Provides early warning of accidental releases; Real time data for evaluation of regional transport model;	Design, procure, install, and maintain data transmission equipment; May need regulators approval to use present sensors; Some potential for embarrassment or liability
	Meteorological Data	Portion of real time transport parameters for modeling airborne regional transport	Design, procure, install, and maintain data transmission equipment; May need regulators approval to use present sensors
	Water Transport Data	Portion of real time transport parameters for modeling waterborne regional transport	Design, procure, install, and maintain data transmission equipment; May need regulators approval to use present sensors

Appendix B - Example Benefits and Costs of Sharing

Waste Disposal Facility Environmental Protection Information

	Example Information	Benefits of Sharing Information	Costs of Sharing Information
DISCUSS	Disposal Facility Effluent Release History	Provides effluent source term for historic modeling of regional transport; Supports historic transport modeling to evaluate if normal operations of the facility are a risk to the region	Staff time to gather and send records; Some potential for embarrassment or liability
	Facility Waste Acceptance Criteria	Supports bounding analyses to evaluate if normal operations of the facility are a risk to the region	Staff time to gather and send Waste Acceptance Criteria documentation
	Historic Waste Characterization Data	Supports 'more realistic than bounding' analyses to evaluate if normal operations of the facility are a risk to the region	Staff time to gather and send records
VISIT	Waste Disposal Facility Design and Site	Builds confidence that the facility design and the facility site are appropriate	Staff time to host visit and, if requested, send associated documents or reports
	Waste Characterization Activities	Builds confidence that waste characterization processes are appropriate	Staff time to host visit and, if requested, send associated documents or reports
	Waste Package External Radiation Levels	Provides independent check and increased confidence for portions of waste characterization	Staff time to host visit and, if requested, send associated documents or reports
	Waste Disposal Facility Regulator	Builds confidence in regulatory oversight of environmental protection issues	Staff time to host visit and, if requested, send associated documents or reports
MONITOR	Disposal Facility Effluent Radiation Monitors	Provides early evidence that a regional release does not come from the facility; Provides early warning of accidental releases; Real time concentration source term for regional transport model	Design, procure, install, and maintain data transmission equipment; May need regulators approval to use present sensors; Some potential for embarrassment or liability
	Real Time Airborne and Waterborne Radionuclide Concentrations Prior To, During, and After Waste Acceptance	(Prior To) Establishes pre-facility background [allows faster and more accurate identification of accidental release when waste is there]; (During and After) Provides early indication that a regional release does not come from a nearby facility; Provides early warning of accidental releases; Real time data for evaluation of regional transport model	Design, procure, install, and maintain data transmission equipment; May need regulators approval to use present sensors; Some potential for embarrassment or liability

Appendix C - Example Benefits and Costs of Sharing

Light Water Reactor Operational Safety Information

	Example Information	Benefits of Sharing Information	Costs of Sharing Information
DISCUSS	Operator Recertification Records	Builds confidence in operator training	Staff time to gather and send records
	Unusual Occurrence Reports	Builds confidence in tracking and resolution of unusual occurrences	Staff time to gather and send records
	Review Of Probabilistic Risk Assessments (PRAs)	Builds confidence in regulatory analyses, oversight and identification of key issues	Staff time to gather and send records
	Test and Maintenance Records	Builds confidence in maintenance and availability of primary and back-up safety systems	Staff time to gather and send records
	Sample of Test and Maintenance Activities	Builds confidence in maintenance and availability of primary and back-up safety systems	Staff time to host visit and, if requested, send associated documents or reports
VISIT	Annual Visits	Builds confidence in continuation of operational safety programs	Staff time to host visit and, if requested, send associated documents or reports
	Unannounced Focused Observations of Topics Identified By Review of Documents	Builds confidence that topics identified by review of documents have been addressed	Staff time to host visit and, if requested, send associated documents or reports; Unannounced nature makes scheduling staff support difficult
	LWR Effluent Radiation Monitors	Provides early indication that a regional release does not come from the facility; Provides early warning of accidental releases; Real time source term for regional transport model	Design, procure, install, and maintain data transmission equipment; May need regulators approval to use present sensors; Some potential for embarrassment or liability
MONITOR	Reactor Thermal and Plant Electrical Output Power	Provides improved estimate of upper bound accident source term; Builds confidence in stability and quality of plant operation	Design, procure, install, and maintain data transmission equipment; May need regulators approval to use present sensors
	Meteorological Data	Portion of real time transport parameters for modeling airborne regional transport	Design, procure, install, and maintain data transmission equipment
	Availability of Back-Up Safety Equipment	Builds confidence that scheduling of maintenance activities is consistent with maintaining an acceptably high level of plant safety	Design, procure, install, and maintain data transmission equipment (could be done with e-mail or fax)
	Key Safety Functions	Early warning in case of accident; Provide technical help in case of accident	Design, procure, install, and maintain data transmission equipment; May need regulators approval to use present sensors; Some potential for embarrassment or liability

Appendix D - Example Benefits and Costs of Sharing

Waste Disposal Facility Operational Safety Information

	Example Information	Benefits of Sharing Information	Costs of Sharing Information
DISCUSS	Safety Analysis Documentation	Independent review of accident scenarios and analyses; May provide bounds for regional transport analyses	Staff time to gather and send safety analysis documents
	Waste Disposal Facility As-Built Drawings	Builds confidence that as-built facility is consistent with the safety analysis	Staff time to gather and send drawings
	Unusual Occurrence Reports	Builds confidence that follow-up action occur	Staff time to gather and send reports
	Test and Maintenance Records	Builds confidence that safety equipment is tested and maintained	Staff time to gather and send records
	Site Characterization Data	Independent review of long-term accident scenarios and analyses	Staff time to gather and send site characterization documentation
VISIT	Compare Actual Safety Systems With As-Built Drawings	Builds confidence that safety features included in safety analyses are included in the design and construction	Staff time to host visit and, if requested, send associated documents or reports
	Maintenance of Safety Systems	Builds confidence that operational safety systems are appropriately maintained	Staff time to host visit and, if requested, send associated documents or reports
	Compare On-Site Waste With Waste Acceptance Criteria	Builds confidence that the waste characterization results in accepted waste meeting the waste acceptance criteria	Staff time to host visit and, if requested, send associated documents or reports
MONITOR	Real Time Airborne and Waterborne Radionuclide Concentrations	Provides early indication that a regional release does not come from the facility; Provides early warning of accidental releases; Real time concentration source term for regional transport model	Design, procure, install, and maintain data transmission equipment; May need regulators approval to use present sensors; Some potential for embarrassment or liability
	Individual Waste Package Radionuclide Inventory	Provides confidence that waste receipt is consistent with the radionuclide inventory portion of the waste acceptance criteria	Design, procure, install, and maintain data transmission equipment; May need regulators approval to use present sensors

Appendix E - Example Benefits and Costs of Sharing Light Water Reactor Material Protection Information

	Example Information	Benefits of Sharing Information	Costs of Sharing Information
DISCUSS	Discuss Fresh Fuel Protection Program	Builds confidence that fresh fuel storage and movements are appropriately protected from theft and sabotage	Staff time to evaluate information sensitivities, hold discussion and as appropriate gather and send records
	Discuss Spent Fuel Protection Program	Builds confidence that spent fuel on-site movements, storage and disposition are appropriately protected from theft and sabotage	Staff time to evaluate information sensitivities, hold discussion and as appropriate gather and send records
	Discuss Waste Storage and Treatment Protection Program	Builds confidence that on-site nuclear waste storage and treatment operations are appropriately protected from theft and sabotage	Staff time to evaluate information sensitivities, hold discussion and as appropriate gather and send records
VISIT	Observe Fresh Fuel Protection Operations	Builds confidence that the as-built facility implements the design criteria and operations are appropriate	Staff time to evaluate observation sensitivities, host visit and as appropriate send associated documents or reports
	Observe Spent Fuel Protection Operations	Builds confidence that the as-built facility implements the design criteria and operations are appropriate	Staff time to evaluate observation sensitivities, host visit and as appropriate send associated documents or reports
	Observe Waste Storage and Treatment Protection Operations	Builds confidence that waste (primarily low level) inventories are appropriately protected from theft and sabotage	Staff time to evaluate observation sensitivities, host visit and as appropriate send associated documents or reports
MONITOR	Event triggered Video Monitoring of On-Site Nuclear Material Storage and Movements	Builds confidence that on-site access to nuclear materials is controlled and that on-site nuclear material movements are appropriate	Design, procure, install, and maintain data transmission equipment; Some long-term video coverage could disclose sensitive aspects of material protection systems to thieves or saboteurs
	Location and Condition Monitoring of Off-Site Nuclear Material Movements	Builds confidence that off-site nuclear material movements have not been stolen or sabotaged	Design, procure, install, and maintain data acquisition and transmission equipment; Location information needs to be encrypted or it could reveal the off-site material location to thieves or saboteurs

Appendix F - Example Benefits and Costs of Sharing

Waste Disposal Facility Material Protection Information

	Example Information	Benefits of Sharing Information	Costs of Sharing Information
DISCUSS	Disposal Facility Design Records	Builds confidence that the design requirements and the design address theft and sabotage issues	Staff time to gather and send records; Some detailed design records may disclose sensitive aspects of material protection systems
	Waste Acceptance Criteria	Provides upper bound of amount and form of materials to be protected and supports an upper bound source term for dispersal impact analysis	Staff time to gather and send records
	Waste Characterization Data	Provides more realistic indication of forms of nuclear materials to be protected	Staff time to gather and send records
	Waste Package Radionuclide Inventories	Provides more realistic indication of amount of nuclear materials to be protected	Staff time to gather and send records
VISIT	As Built Disposal Facility	Builds confidence that material protection aspects of the design, both pre- and post-closure, exist in the as-built facility	Staff time to host visit and, if requested, send associated documents or reports; Some sensitive material protection systems could be compromised
	Waste Characterization Equipment	Builds confidence in the waste characterization process and data	Staff time to host visit and, if requested, send associated documents or reports
	Waste Disposal Facility Regulator	Builds confidence in regulatory oversight of material protection related issues	Staff time to host visit and, if requested, send associated documents or reports>
	Review Site and Repository Facility Closure Plan	Builds confidence that repository closure is permanent and that attempts to steal or sabotage nuclear material could be identified	Staff time to host visit and, if requested, send associated documents or reports
MONITOR	Event Triggered Video Coverage of Nuclear Material Movements During Repository Operations	Builds confidence that access is controlled and that movements of nuclear material are appropriate during the repository operational period	Design, procure, install, and maintain data acquisition and transmission equipment
	Event Triggered Seismic Coverage After Repository Closure	Builds confidence that the repository remains closed with no effort to steal or sabotage the nuclear materials contained within the closed repository	Design, procure, install, and maintain data acquisition and transmission equipment; Need to define a process (on-site inspection is one option) for resolving natural versus material recovery seismic events